

CLAIMS:

1. An electrophoretic display device (1) comprising an electrophoretic material comprising charged particles (8, 9) in a fluid (10), a plurality of picture elements, first and second electrodes (5, 6) associated with each picture element, the charged particles (8, 9) being able to occupy a position being one of a plurality of positions between said electrodes (5, 6), said positions corresponding to respective optical states of said display device (1), and drive means arranged to supply a drive waveform to said electrodes (5, 6), said drive waveform comprising a plurality of image update sequences including drive signals for effecting image transitions in respect of said picture elements so as to cause said charged particles (8, 9) to occupy one of said optical states according to an image to be displayed, wherein at least one voltage pulse is applied to said electrodes (5, 6) at or near the end of selected one or more image update sequences for drawing said charged particles (8, 9) back towards an optical state in which a picture element is required to remain during a respective image update sequence.
2. A display device (1) according to claim 1, wherein the at least one voltage pulse is applied in the drive waveform at or near the end of a drive signal intended to cause a picture element in an initial extreme optical state, whereby the charged particles (8, 9) are adjacent one of the electrodes (5, 6), to remain in that optical state.
3. A display device (1) according to claim 1 or claim 2, wherein the at least one voltage pulse is applied in a drive waveform intended to cause a picture element to remain in an intermediate optical state.
4. A display device (1) according to any one of the preceding claims, wherein the value of a drive signal intended to cause a picture element to remain in the same optical state during an image update is substantially zero.
5. A display device (1) according to any one of the preceding claims, wherein the drive waveform is voltage modulated.

6. A display device (1) according to any one of claims 1 to 4, wherein the drive waveform is pulse width modulated.
- 5 7. A display device (1) according to any one of the preceding claims, wherein the drive waveform is substantially dc-balanced.
8. A display device (1) according to any one of the preceding claims, comprising two substrates (2), at least one of which is transparent, the charged particles (8, 9) and the
10 fluid (10) being situated between the two substrates.
9. A display device (1) according to any one of the preceding claims, wherein the charged particles (8, 9) and the fluid (10) are encapsulated.
- 15 10. A display device (1) according to claim 9, wherein the charged particles (8, 9) and the fluid (10) are encapsulated in a plurality of individual microcapsules, each defining a respective picture element.
11. A display device (1) according to any one of the preceding claims, wherein
20 one or more shaking pulses are provided in each image update sequence, prior to the drive signal.
12. A display device according to claim 11, wherein the shaking pulse has an opposite polarity as the subsequent data pulse when a single shaking pulse is applied.
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13. A display device (1) according to any one of the preceding claims, wherein one or more reset pulses are applied in each image update sequence, prior to the drive signal.
14. A display device (1) according to claim 13, wherein the reset pulse, prior to a
30 drive signal, comprises an additional reset duration.
15. A display device (1) according to any one of claims 1 to 14, wherein image transitions include pixels without substantial optical state change.

16. A display device (1) according to any one of the preceding claims, wherein at least one individual drive waveform is substantially dc-balanced.

17. A display device according to any one of the preceding claims, wherein at least some of the sub-sets of closed loops wherein an image transition cycle causes a pixel to have substantially the same optical state at the end of said cycle as at the beginning, are substantially dc-balanced.

18. A method of driving an electrophoretic display device (1) comprising an electrophoretic material comprising charged particles (8, 9) in a fluid (10), a plurality of picture elements, first and second electrodes (5, 6) associated with each picture element, the charged particles (8, 9) being able to occupy a position being one of a plurality of positions between said electrodes (5, 6), said positions corresponding to respective optical states of said display device (1), the method comprising supplying a drive waveform to said electrodes (5, 6), said drive waveform comprising a plurality of image update sequences including drive signals for effecting image transitions in respect of said picture elements so as to cause said charged particles (8, 9) to occupy one of said optical states according to an image to be displayed, wherein at least one voltage pulse is applied to said electrodes (5, 6) at or near the end of selected one or more image update sequences for drawing said charged particles (8, 9) back towards an optical state in which a picture element is required to remain during a respective image update sequence.

19. Apparatus for driving an electrophoretic display device (1) comprising an electrophoretic material comprising charged particles (8, 9) in a fluid (10), a plurality of picture elements, first and second electrodes (5, 6) associated with each picture element, the charged particles (8, 9) being able to occupy a position being one of a plurality of positions between said electrodes (5, 6), said positions corresponding to respective optical states of said display device (1), the apparatus comprising drive means arranged to supply a drive waveform to said electrodes (5, 6), said drive waveform comprising a plurality of image update sequences including drive signals for effecting image transitions in respect of said picture elements so as to cause said charged particles (8, 9) to occupy one of said optical states according to an image to be displayed, wherein at least one voltage pulse is applied to said electrodes (5, 6) at or near the end of selected one or more image update sequences for

drawing said charged particles (8, 9) back towards an optical state in which a picture element is required to remain during a respective image update sequence.

20. A drive waveform for driving an electrophoretic display device (1) comprising
- 5 an electrophoretic material comprising charged particles (8, 9) in a fluid (10), a plurality of picture elements, first and second electrodes (5, 6) associated with each picture element, the charged particles (8, 9) being able to occupy a position being one of a plurality of positions between said electrodes (5, 6), said positions corresponding to respective optical states of said display device (1), the apparatus comprising drive means arranged to supply said drive
- 10 signal to said electrodes (5, 6), said drive waveform comprising a plurality of image update sequences including drive signals for effecting image transitions in respect of said picture elements so as to cause said charged particles (8, 9) to occupy one of said optical states according to an image to be displayed, wherein at least one voltage pulse is applied to said electrodes (5, 6) at or near the end of selected one or more image update sequences for
- 15 drawing said charged particles (8, 9) back towards an optical state in which a picture element is required to remain during a respective image update sequence.